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Extraordinary Optoconductance in GaAs-In Hybrid Structures[1]

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— Following the demonstration of extraordinary magnetoresistance (EMR) in semiconductor-metal hybrids[2] it has been realized that EMR is but one example of a general class of EXX phenomena that can be geometrically enhance by the judicious choice of sample geometry, lead placement and the location, size and shape of any inhomogeneities. The second EXX phenomenon to be demonstrated was extraordinary piezoconductance, EPC[3]. Here we report a third EXX phenomenon, extraordinary optoconductivity, EOC. The optoconductivity of a macroscopic 4-contact van der Pauw plate structure consisting of Si-doped GaAs ($n \sim 1times10^{18}$ cm^{-3}) with an In shunt was compared to that of a shuntless sample. The conductance of each sample was measured as a function of temperature and of the position and wavelength of a focused Ar ion laser beam (spatial resolution of $10\mu m$). At room temperature the short carrier mean free path (λ) resulted in a photovoltaic response that was diminished by the shunt. In contrast, at low temperature the longer λ results in EOC that, at 15K, is more than 400% larger in the shunted sample relative to the the unshunted sample.

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[2]S.A. Solin et al., Science bf289, 1530 (2000).
[3]A. C. H. Rowe et al., Appl. Phys. Lett. bf83, 1160 (2003).

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